

## EXECUTIVE SUMMARY FOR THE EMERGENCY RESPONSE OPERATIONS

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### E.1 PURPOSE AND SCOPE

This effort builds upon work already done by The Fire Department of the City of New York (FDNY), The New York City Police Department (NYPD), and McKinsey & Company by:

- fully documenting what happened during the response by the fire service and other emergency responders to the attacks on the World Trade Center (WTC), up to the time of collapse of WTC 7
- identifying issues that need to be addressed in changes to practice, standards, and codes

It goes substantially beyond the work previously done by others.

**Task 1.** Collect emergency response data to document emergency responder fatalities, command and control procedures, and equipment performance. Records of interest included dispatch logs, recorded radio communications, run logs from surviving responding units, 9-1-1 records, data recorded by The Port Authority of New York and New Jersey (PANYNJ or Port Authority) operations, FDNY, NYPD, and fire ground positioning of emergency apparatus. Information was collected on operations and functions of communication systems, on-site emergency information systems, fire alarm panels, elevator control panels, standpipes and fire hoses, and other pre-positioned emergency equipment. In coordination with project seven, oral history data was collected from witnesses, those in control of emergency operations, and surviving emergency responders to the extent their oral history had not already been documented. Technical experts reviewed and conducted a fact-based analysis of the data.

**Task 2.** Interpret the factual analysis to determine the effect on responder successes of factors such as:

- the influence of building design (e.g., height, stairways, elevators, smoke control systems) on fire service command and control procedures, life saving operations, and safety of emergency responders;
- the influence of aircraft impact damage and fuel run-off on fire service command and control procedures, life saving operations, and safety of emergency responders;
- the impact of systems failures (e.g., communication systems, water supply, sprinklers, standpipes) on fire service command and control procedures, life saving operations, and safety of emergency responders;
- building occupant egress as related to emergency responder operations;
- the ability to fight large fires on the upper floors of tall buildings;

- the impact that the 1993 bombing of the WTC had on codes, standards, and procedures that affected emergency responders in tall buildings;
- pre-planning, training, and standard operating procedures (including command and control) at the time of the WTC attack on September 11, 2001;
- emergency responder accountability, location, and tracking,
- fire and emergency response protocols for tall buildings;
- the resources available for initial situation assessment and incident management, and practices for determining the possibility of structural collapse; and
- communication and coordination of response activities among the various authorities at the WTC.

Review of various public records showed that most of the data needed for the investigation were maintained by the three organizations that contributed to the emergency response: the PANYNJ, FDNY, and NYPD. Also, a significant amount of information was available through the various media services. Data sources were identified using several different techniques:

- News media accounts were examined;
- Books and other public records concerning WTC operations were examined;
- Public comments were received via the WTC information e-mail address and phone line concerning information sources;
- Team members met with each of the various organizations in an attempt to identify data sources;
- First-person interviews were used to identify data; and
- Emergency responder experts were employed and assisted with identifying data sources.

After the data sources were identified, written requests were made to each of the agencies that were determined to possess data. The requests were followed by meetings and discussions during which agreements were formalized, setting rules for the transfer and protection of the data. After the agreements were completed, the data were transferred to National Institute of Standards and Technology (NIST), or NIST team members accessed the data at locations identified in the agreements. Approximately half of the data requested were transferred to NIST and were entered into the investigation's files. The other half of the data was studied at agreed upon locations in the New York City area.

Four types of data were identified for this investigation: documentary data, electronic data, first-person interview data, and visual data.

## Documentary Data

- Policies, protocols, and standards used by the various agencies for conducting operations at the WTC,
- Records and documents generated by the various agencies during operations at the WTC, and
- Records and documents generated following the incident, including investigative reports such as the McKinsey and Company reports for FDNY and NYPD, and records documenting investigative first-person interviews.

## Electronic Data

There were two forms of electronic data collected from the three emergency responder departments:

- Radio communication recordings and
- Telephone communication recordings

## First-Person Interviews

In October 2003, NIST entered into a three-party agreement between NIST, New York City (NYC), and the National Commission on Terrorist Attacks Upon the United States (the 9/11 Commission). The agreement provided procedures under which NIST and the 9/11 Commission would interview a maximum of 125 NYC emergency responders, 100 from FDNY and 25 from NYPD.

In December 2003, NIST officially requested and the Port Authority agreed to interviews with twelve Port Authority personnel, including emergency responders, safety, security, and management personnel.

The first-person interviews were conducted beginning in December 2003 and were completed in June 2004.

The following represents the number of interviews conducted by NIST with each organization:

- FDNY = 68

Senior management and officers, mid-level officers, company officers, firefighters, emergency medical personnel, and dispatchers

- NYPD = 25

Senior management and officers, mid-level officers, emergency service unit personnel, aviation personnel, and dispatchers

- PANYNJ/PAPD = 15

Senior management personnel, facility safety personnel, building security personnel, facility communication personnel, building vertical transportation personnel, senior PAPD officers, mid-level PAPD officers, and PAPD officers

- OTHER = 8

Interviewees in this group contacted NIST directly or through third parties and indicated that they would like to be interviewed. Approximately half of these individuals were retired FDNY personnel. The group consisted of a building security guard, building engineers, a dispatcher, firefighters, and a fire safety director.

- Total Interviews = 116

## Visual Data

- Photographs, film, and digital;
- Motion images, video clips, and movie film

Dr. William Pitts of NIST and his staff acquired a large amount of the visual data. Numerous photographs and video records were acquired from FDNY and NYPD. Uncut video was acquired from the Naudet brothers' documentary and video news organizations. Thousands of photographs and video clips were obtained from the PANYNJ and other New York City sources, including the media and the public.

## E.2 ANALYSIS AND FINDINGS

### Changes Made by the PANYNJ Following the February 1993 WTC Bombing

After the February 1993 bombing, the following changes were made at the World Trade Center by the PANYNJ that had a direct impact on emergency responder operations on September 11, 2001:

- Work on the installation of automatic sprinkler systems was accelerated. The installation of automatic sprinkler systems began prior to 1993 and involved WTC 1 and WTC 2.
- Improvements were made to the Concourse level of the WTC to improve egress.
- A new Port Authority Police Command Center was established inside WTC 5.
- Fire Command Desks were installed in the lobbies of WTC 1 and WTC 2.
- A radio repeater (radio repeater: an electronic device for amplifying and retransmitting a radio signal) was installed in WTC 5 that operated on the FDNY city-wide high-rise frequency. The antenna was located on the top of WTC 5 and was directed at WTC 1 and WTC 2. Controls for operating the repeater were originally located at the PAPD Police

Command Center inside WTC 5. During the spring of 2001, controls for repeater operation were moved to the Fire Command Desks inside the lobby of each of the two towers.

- The elevator intercom system was upgraded and could be monitored at the Lobby Fire Command Desk in each tower.
- A new Operations Control Center with the capability to monitor all HVAC systems and elevators was constructed on the B1 level of WTC 2.
- Multiple power sources were installed for exit stairway lighting in the towers.
- WTC 1 and WTC 2 received a new decentralized Fire Alarm System, Class E (Style 7), with three separate data risers to transponders located every three floors, with redundant control panels and electronics, and multiple control station announcement capability.
- Fire drills were conducted in conjunction with FDNY.

### **Changes Made by FDNY Following the February 1993 WTC Bombing**

**Incident Command System:** The scope of the February 1993 bombing was beyond anything ever experienced by FDNY, and information overload occurred at the incident command level. Tasks to resolve issues related to the 1993 bombing were delegated along the lines of the FDNY incident command system in the following areas: command, planning, operations, logistics, and finance. It was also recognized that all agencies must be sensitive to and coordinate operations for effective incident command. The May 1997, Incident Command System manual and its new policies had been in operation with FDNY for approximately four years when the WTC attack occurred on September 11, 2001.

#### **Communications:**

- To improve communications at a large incident, the city purchased eighty 800-megahertz radios for use by deputy fire commissioners, each staff chief, and the Field Communications Unit. Twenty of the radios were to be distributed by the Field Communications unit at an incident, if needed.
- A high-rise repeater was requested by FDNY for operations in the WTC, and the Port Authority installed it in WTC 5.
- FDNY companies that were located near the WTC and often responded to the WTC were issued Port Authority radios that allowed them to communicate with the building's Deputy Fire Safety Directors and with PAPD.

**Interagency Protocols:** The New York City Office of Emergency Management (OEM) was established, and it took on the job of promoting the improvement of interagency operations; however, on September 11, 2001, the OEM center located at WTC 7 became ineffective as WTC 7 was evacuated by the emergency response personnel.

**Building Systems and Fire Safety Personnel:** In 1993, the Port Authority and New York City entered into two Memoranda of Agreement related to fire safety of Port Authority facilities located in New York City. The first agreement allowed for the implementation of fire safety recommendations that would be made by FDNY after they had inspected PANYNJ facilities located in New York City. The second agreement recognized the right of FDNY to conduct fire safety inspections of PANYNJ properties in New York City. It provided guidelines for FDNY to communicate needed corrective actions to the PANYNJ, and it assured that new or modified fire safety systems were to be in compliance with local codes and regulations. It also required a third party review of the systems by a New York State licensed architect or engineer.

### **September 11, 2001, Attack on the World Trade Center**

**Initial “Size-up” and Impact of Aircraft Damage to WTC 1:** The first command officer from FDNY to arrive at WTC 1 had actually seen the airplane strike WTC 1. While responding to WTC 1, he radioed Manhattan dispatch to advise them that “a plane had hit the World Trade Center” and that “they have a number of floors on fire.” Upon entering WTC 1 and going to the fire command desk to set up the Lobby Command Post, he met with the building Fire Safety Director to determine what damage the building had sustained. During first-person interviews, FDNY personnel provided the following information related to building conditions and emergency response operations in WTC 1:

- It was determined that the elevators were not working and/or were not safe for use; therefore, firefighters would have to gain access to injured and trapped occupants by climbing the stairs and carrying the equipment needed.
- It was likely that the water supply to the stand pipe and automatic sprinkler systems on the upper floors was damaged and that firefighting would not be an option until a reliable water supply was established and equipment was carried up to the fire floors.
- FDNY command personnel learned from 9-1-1 dispatch operators that smoke, fire, and structural damage in the building prevented many building occupants from evacuating floors above the impact zones.
- FDNY command personnel knew that jet fuel had flowed into the elevator shafts and into other parts of the buildings and presented a danger to building occupants and emergency responders.
- Communication systems to the upper floors via Warden Phones and Stand Pipe phones were not working.
- The building communication system used to make emergency announcements to building occupants was not working.

Based on the following facts, the fire chiefs who established the original Command Post inside the lobby of WTC 1 concluded that the fire department efforts should be directed toward evacuation and rescue of

building occupants:<sup>1, 2, 3</sup> the impact zone and fires were so high in the building, there were large fires on multiple floors, the building's water supply was compromised, and there were no working elevators that could transport fire fighters and equipment up to a staging area just below the impact zone. Firefighting operations on the upper floors would not have been a reasonable option at that time. The building conditions indicated that, at best, it would take hours to establish meaningful firefighting operations on the upper floors of the building. The chiefs knew that this assessment did not give much hope for the survival of the people trapped above the fires since the fires would continue to grow and the toxic fire gases would occupy the building spaces where the people were trapped. It was likely that many of the occupants trapped at and above the impact zone would die before help could get to them.

**Physiological Impact of Climbing Stairs:** All three responding agencies sent personnel up the stairs in both WTC 1 and WTC 2. With the elevators inoperable, all equipment necessary for firefighting, rescue, and treatment of injured occupants had to be carried up the stairs. A normally outfitted FDNY firefighter wearing full protective clothing (coat, pants, helmet, hood, boots, gloves) and Self-Contained Breathing Apparatus (SCBA) carries approximately 23 kg (50 lbs) of equipment. Additional equipment, such as radios, lights, extra air bottles, forcible entry equipment, ropes, medical kits, or hose packs and appliances may add another 23 kg (50 lbs) or more to the work load. It is not unusual for firefighters to be carrying loads in excess of 46 kg (100 lbs) into a building when fighting a fire. The NYPD Emergency Service unit (ESU) and PAPD officers who ascended the stairs also wore SCBA. Much of the equipment they carried was similar to that of the Fire Department. The major difference between the Fire Department and Police Department outfitting was that the Police Department personnel did not wear protective clothing designed for firefighting.

From the time of the first airplane impact into WTC 1 to the collapse of WTC 2, a period of approximately one hour and 12 minutes, emergency responders inside WTC 1 were able to climb to floors in the 40s. However, a small number of emergency responders got to floors in the 40s by taking the only operating elevator to the 16<sup>th</sup> floor and then using the stairs. A report from one building occupant indicated that they saw firefighters located on floors about in the 50s.<sup>4</sup> (NIST 2004) Within WTC 2, one FDNY Battalion Chief and Ladder Company got to floors in the 70s. They were able to take an elevator from the lobby to the 40<sup>th</sup> floor before having to walk up the stairs. According to interview information, the consequences of firefighters and other emergency responders having to climb many tens of floors to get to a fire or other high-rise building emergency without the use of elevators are summarized as follows:

- The ability to get both personnel and needed equipment to the desired location is limited by building height.
- Emergency responders wearing police uniforms, not wearing a SCBA or carrying extra equipment, were able to climb the stairs at a rate of approximately 1.4 minutes per floor while climbing to floors in the 40s inside of WTC 1.

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<sup>1</sup> FDNY interview 2, winter 2003

<sup>2</sup> FDNY interview 7, winter 2004

<sup>3</sup> FDNY interview 20, winter 2004

<sup>4</sup> Interview 1000118 (NIST 2004)

- Emergency responders wearing full firefighter turnout gear, wearing a SCBA, and carrying extra equipment were able to climb the stairs at a rate of approximately 2.0 minutes per floor while climbing to floors in the 30s and 40s inside of WTC 1.
- Emergency response time factors related to the rate of fire growth, the ability to rescue building occupants, and the ability to bring a fire under control become more critical with every additional floor in building height.
- The ability of emergency responders to climb stairs with equipment and remain physically fit to conduct rescue and firefighting operations, treat injured occupants, and remove them is diminished with every additional floor in building height that must be climbed.

**Situational Awareness:** Situational awareness was an overriding issue with all emergency responders during operations at the WTC site. First-person interviews with emergency responders from all agencies highlight the importance of situational awareness during this complex emergency response. Results from the interviews showed that there were two basic levels of situational awareness:

1. Emergency responders working outside the buildings, with the ability to observe events and conditions as they changed felt that they had good situational awareness. In addition, emergency responders who worked inside the buildings and had reliable radio communications with people outside the building felt that their situational awareness was good.
2. Emergency responders who worked inside the buildings and had no reliable means of communication other than face-to-face communications felt that they had poor situational awareness.

Some senior emergency responder officers inside WTC 1 felt that their situational awareness was poor even though they were in radio contact with other senior officers outside the building. One of these senior officers stated that *he would have known more about what was going on during the incident if he had been home watching it on TV.*<sup>5</sup>

For emergency responders already inside WTC 1, it took time to confirm that a second aircraft had actually hit WTC 2. A large number of emergency responders working inside WTC 1 realized that something had happened but did not know that a second aircraft struck WTC 2. Some emergency responders who were going up in the stairways inside WTC 1 did not know that anything had happened when the second aircraft struck WTC 2.

**Accountability for and Tracking of Emergency Responders:** Accountability encompasses the assignment, dispatch, checking in, tracking, locating, and checking out of emergency responders operating at an emergency. With the WTC attack, accountability also involved the recall of emergency responders. Recall refers to bringing emergency responders who are off duty back to duty status. All responding agencies had recall policies in place and did recall personnel for WTC operations. In addition, a few emergency responders self-dispatched to the World Trade Center, and as the recalls were put into

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<sup>5</sup> FDNY interview 7, winter 2004.

effect some emergency responders went to the scene instead of reporting to their assigned location, causing accountability problems at the WTC complex.

All emergency responder organizations had accountability, location, and tracking plans in place, and they generally worked well during the first 30 minutes of WTC operations. However, the FDNY system became overwhelmed with the large number of units and personnel arriving at the scene. FDNY used magnetic Command Boards to keep track of personnel during operations. NYPD kept their personnel and tracking information on a clipboard and paper, and PAPD maintained their accountability and tracking information at the PAPD Police Desk inside WTC 5. All emergency responder (FDNY, NYPD, and PAPD) accountability and tracking systems and records were lost when WTC 2 collapsed, and there was no backup for these lost records.

The FDNY Chiefs in charge of the Emergency Medical Services (EMS) operations at the WTC had some difficulties with accountability and tracking of their personnel. The size of the incident, the difficulty in determining early on what EMS units were there, and the self-dispatch of some non-FDNY ambulances added to their difficulties. Not all ambulances operating within New York City are part of the Fire Department. Some respond from hospitals or are from private ambulance companies. One of the biggest problems for the Emergency Medical Services was the lack of control of the ambulances that were not part of the Fire Department.

Location and tracking of personnel is an issue that has been studied by the emergency responder community for many years. Once responders report to a Command Post at the scene of an emergency, receive their assignments, and depart to accomplish their tasks, there is no effective means to locate and track the activities of the units or individuals. On September 11, 2001, the only means for locating and tracking units and personnel was through radio communications. During operations at the WTC, there were so many people using the FDNY radio system for ongoing operations that it became ineffective for locating and tracking personnel.

**Emergency Medical Services Patient Tracking:** There are many reasons to track patients who are triaged, treated and transported from an emergency. One important reason is to ensure that no one medical facility is overwhelmed by an unexpected influx of patients. The objective is not having an ambulance drop a patient off at a hospital, but at a hospital that has the best capabilities to take care of that person, avoiding situations in which any one hospital is overwhelmed. Within the individual triage and treatment areas that were set up by FDNY, efforts were made to keep track of patients. This was done with pencil and paper. All of the data on patients was lost when the buildings collapsed.

**Building Access by Emergency Responders and Evacuation of Civilians by Stairways:** During the September 11, 2001, operations, stairs were the primary means of access to and egress from the World Trade Center towers. Elevator service, practically speaking, did not exist in either of the buildings. Of the 99 elevators that were in each tower, only one elevator in each tower was functional and operated in a limited capacity to the lower third of each building. The egress of building occupants in the stairways and through the stairway doors of WTC 1 and WTC 2 generally had a negative impact on the emergency response operations. Emergency responders reported difficulties negotiating the stairway doors and

stairways as occupants were coming down. Some of the problems experienced by emergency responders were:

- Difficulty accessing the stairway doors and stairways through the lobby and mezzanine levels because of building occupant flow out of the doorways and stairways; only one person could exit or enter the stairway at a time. If an occupant was leaving through the stairway door that stopped the flow of emergency responders into the stairway. If an emergency responder was entering the stairway through the stairway door that stopped the flow of occupants from leaving the stairway.
- Emergency responder team personnel became separated by the counter flow as building occupants moved down the stairs and the emergency responders attempted to move up.
- Emergency responders experienced difficulty in moving equipment up the stairs as building occupants were coming down the stairs.

Emergency responders interviewed stated that the 1.12 m (44 in)-wide stairways could be easily blocked by one person as they attempted to walk down the stairs. An average-sized person could walk down the center of the stairway and place one hand on each of the staircase handrails. This posture would block the stairway for other people who were trying to move faster down the staircase. This posture was identified as being used by mobility-impaired people who were only able to step down to the next step one foot at a time. This resulted in both feet standing on the same step, instead of the unimpaired gait where one foot is placed onto a step and the other foot is placed on the next step down.

Emergency responders also reported that the stairways became plugged and traffic was stopped as individuals with physical disabilities or obese occupants blocked the stairs.

After WTC 2 collapsed, emergency responders inside WTC 1 attempted to exit the building by going down the various stairways. On the way down, some emergency responders stopped and checked each floor to be sure that it was clear before they proceeded down. On about the 12th floor, FDNY personnel found approximately 40 to 60 people who had been removed from the stairway by others and placed onto the floor because these mobility impaired individuals had been blocking the stairway evacuation routes. The emergency responders stopped and began to assist these people with their evacuation. Depending on the disability or size of the person, it took from one to four emergency responders to assist one person with the evacuation. If the individual being assisted required a lot of assistance or was significantly overweight emergency responders had to change teams as fatigue set in. The evacuation pace while assisting the mobility challenged occupants was often described by the emergency responders as very slow. From the FDNY and PAPD interviews, it was not clear how many of the 40 to 60 occupants were safely evacuated from the building before WTC 1 collapsed. It is known from the interviews that a group of about 20 of these individuals were being moved out of WTC 1 just before the building collapsed.

### **Communications:**

**Building Communications:** Upon arrival in the lobby of WTC 1, FDNY personnel were told that the building communication systems used to make emergency announcements to building occupants was not working. Communications to the elevators in the upper third of the buildings were lost. The Warden phones did not work, and attempts to use the wire line phones to upstairs were unsuccessful.

- Building occupants reported that the emergency communication system used to make the emergency announcements inside WTC 1 was inoperable as a result of the aircraft impact.
- The emergency communication system used to make the emergency announcements was inoperable as a result of the aircraft impact. FDNY personnel upstairs inside of WTC 1 also learned that the warden phone system was damaged and the standpipe phone system was not operating.

**Radio Communications:** All of the radio systems analyzed appeared to have been working well during the period of operations just before the attack on the WTC. There were two cases where handie-talkies experienced difficulties with stuck or open microphones just before and during the attack. One of these handie-talkies was used by PAPD, and one was used by NYPD.

High-rise buildings create problems with radio communications. The vast amount of metal and steel reinforced concrete in high-rise buildings is known to attenuate and block radio signals. This problem often occurs with low output power emergency responder handie-talkies. Various documents, including information from the 1993 WTC bombing, highlighted the problems FDNY experienced with radio communications in high-rise buildings. On September 11, 2001, FDNY again experienced poor handie-talkie radio communications within the towers. This had a major impact on FDNY operations particularly inside WTC 1 where no one used the WTC radio repeater system or a Battalion Car Cross Band Repeater. At WTC 2, the FDNY/WTC radio repeater system was used.

**FDNY WTC Radio Repeater:** The FDNY high-rise Channel 7 repeater that was located in WTC 5 was functional during operations at the WTC. This radio repeater received FDNY radio communications on a specified radio frequency, amplified the signal power, and retransmitted the radio communications on another specified radio frequency that the FDNY radios received. Data suggest that the repeater handset was broken and/or the handset volume was turned down so that it could not be heard when the repeater radio check was conducted. Data also suggest that the repeater's antenna system was not damaged. This is based on the fact that radio communications using the repeater system were carried out inside WTC 1 and inside WTC 2. The communications were recorded by the repeater's recording system; therefore, it is unlikely that the antenna was damaged by debris from the aircraft impact.

The recordings of radio communications by the WTC/FDNY repeater system suggest that operations communications inside WTC 2 were assisted by the repeater. Also, the radio recordings show that communications readability using the repeater was generally good to excellent. Where readability levels were poor, it was generally caused by doubling or multiple people attempting to communicate over the repeater at one time. If FDNY personnel in both towers attempted to use the repeater for operations, there would likely have been additional radio traffic that would have resulted in more unreadable communications. However, it would have been likely that the Lobby Command Post in WTC 1 would have had somewhat improved communications with personnel operating in the upper floors of the building up until the time when WTC 2 collapsed. The radio repeater recordings suggest that the repeater system failed during the collapse of WTC 2.

With the collapse of WTC 2 and the failure of the repeater system, the Lobby Command Post inside WTC 1 would have lost its primary means of communication with FDNY personnel. The loss of the repeater produced communications capabilities equivalent to the radio communications situation that the Lobby Command Post inside WTC 1 actually experienced.

Therefore, the apparent repeater failure with the collapse of WTC 2 would not have had any effect on saving lives of FDNY personnel located inside WTC 1. If the repeater had been in use inside of WTC 1 when WTC 2 collapsed, it would have taken time to establish that the repeater system had failed. FDNY personnel would have had to then change radio channels to continue radio communications.

Although the repeater in WTC 1 was working, the earlier tests had indicated, and emergency responders were informed that it was not working. Therefore, emergency responders did not use the repeater in WTC 1. When the repeater actually did fail, with the collapse of WTC 2, there was no effect on emergency responder communications inside WTC 1, since the repeater was not being used.

**Radio Communications Quantity and Quality:** All emergency responders struggled with the high volume of radio traffic at the WTC. The surge in radio traffic significantly impacted the quality of radio communications during operations at the WTC. Data for the various departments demonstrate the significant changes that occurred in radio communications traffic during operations at the WTC. It is evident that PAPD, FDNY, and NYPD all experienced similar surges in radio traffic volume following the first aircraft impact into WTC 1.

Analysis of the radio traffic for each of the departments shows periods where radio traffic rates during the surge conditions potentially resulted in situations where base station radio operators were unable to relay important information.

It is estimated that one-third to one-half of emergency responder radio communications during operations at the WTC on the morning of September 11, 2001, were unreadable or incomplete.

**Radio Communications and Incident Command and Control:** The poor radio communications at the WTC had a serious impact on the FDNY Command Post's attempts to maintain command and control.

**Radio Communications and Evacuation of Emergency Responders from WTC 1:** With the collapse of WTC 2, each emergency responder department sent out radio messages calling for the immediate evacuation of WTC 1. At least three FDNY Chief Officers transmitted urgent radio messages over their handie-talkie radios calling for the evacuation of WTC 1. NYPD ESU personnel inside WTC 1 received their orders to evacuate from an ESU Mobilization Point staff person located at Church and Vesey Streets. PAPD command personnel also called for the evacuation of WTC 1.

From first-person interviews with *surviving* emergency responders who went upstairs in WTC 1, eight of the 15 FDNY personnel interviewed who had handie-talkie radios heard the order to evacuate over their radios. All three NYPD ESU officers interviewed heard the order to evacuate over their radios. Of the two PAPD officers interviewed, one heard the order to evacuate over his radio, and one did not.

Radio communications associated with the order to evacuate WTC 1 had mixed results after the collapse of WTC 2. Data show that some heard the evacuation orders while other personnel on the same floor did not hear the orders. Lack of timely information sharing and inadequate communications capabilities likely contributed to the loss of emergency responder lives.

**Coordination of Response Activities with Other Authorities at the World Trade Center:** In general, on the morning of September 11, 2001, all departments attempted to work together to save as many lives as possible and protect the citizens of New York City. At the same time, first-person interviews with

FDNY and NYPD personnel showed that at times some issues related to a given department's operational responsibility and the competitive nature of departments did exist. However, emergency responder interviews also suggest that inter-agency competition had minimal effect on operations at the WTC before the towers collapsed.

The Office of Emergency Management (OEM) was established in New York City after the 1993 bombing, in part, to promote unified operations between and among the various city emergency responder departments. On the morning of September 11, 2001, OEM operations were disrupted with the loss of the city's OEM operations center located inside WTC 7. Since the OEM center was not available for operations, NYPD, FDNY, and OEM Commissioners met the Mayor on the street with the group initially assembling at Barclay Street. At the same time, NYPD was establishing an alternate command center for the Mayor and his staff at 75 Barclay Street so that he and his staff could oversee operations. (Giuliani 2002). However, their operations from 75 Barclay Street were disrupted by the collapse of the towers, and they had to quickly evacuate from that site. Data show that there was no formal structure of unified command between departments below the Mayor and Commissioner level of operations. FDNY and NYPD department chiefs were not working together at the same command post, and they did not formulate unified orders or directions for their departments.

NYPD generally has different responsibilities from FDNY related to security, traffic control, protection of the public and the crime scene, etc. However, there were overlapping functions with NYPD ESU rescue team operations inside and around the WTC towers and FDNY operations. Although ESU rescue teams eventually joined and worked with FDNY personnel, functional unified operations were diminished as a result of the two departments' command posts being separated. In addition, the separate command posts could not communicate with each other on their different radio systems, and neither FDNY nor NYPD had liaison officers working with the other department's command post until after WTC 1 collapsed.

The coordination of communications and operations between the responding authorities at the WTC was a challenge for all emergency responders working that morning. The short time frame related to the attack and emergency responder operations coupled with successive significant threats requiring response (an aircraft hitting WTC 2 after WTC 1 was hit, the possible threat of a third aircraft coming in, the collapse of WTC 2, etc.) compounded the difficulty of establishing a unified operation. The challenges related to the establishment of unified operations were made significantly worse when the OEM facility located inside WTC 7 had to be evacuated. Although there was merit to having the FDNY and NYPD Command Posts separated, there was no uniform means for communicating between the two Command Posts at the time when WTC 2 collapsed. FDNY and NYPD primarily operated as independent organizations based on their operational responsibilities. However, FDNY, EMS, NYPD, PAPD, PANYNJ, and OEM attempted to work together. These attempts to work together were stymied by a lack of existing protocols that clearly defined authorities and responsibilities, communications systems problems, and multiple major attacks and threats.

**Emergency Responder/News Media Communications:** Evaluation of emergency responder/news media operations indicates that communications between the organizations was less than totally effective. Critical information related to life safety and evacuation from the WTC towers was not transmitted to the news media so that it could be broadcast to people threatened by the attack and building fires. At times, news media inquiries interfered with emergency responders as they attempted to carryout life safety operations. Appropriate emergency response agency contact points were bypassed or not used by some

news media for gathering information. It appears that emergency response agencies were overwhelmed by news media requests for information.

## **Emergency Response Issues**

***Preplanning:*** Preplanning is an integral part of all emergency response operations. Building owners and operators, fire departments, emergency medical services, and police departments need pre-plans that address safety issues associated with potentially high risk properties like the WTC. Not only do these groups need to develop pre-plans for emergencies in high-rise buildings, they need to be sure that each of the pre-plans appropriately link to form a cohesive and functional unified plan. The 1993 attack on the WTC heightened FDNY's awareness of the need for preplanning and command organization that went beyond the scale of operations carried out during the 1993 bombing. Even with their preplanning, many of the same difficulties experienced during the 1993 bombing were evident during the September 11, 2001, emergency response to the WTC. Some of these were:

- Poor radio communication inside the buildings and its effect on command and control.
- Buildings were not clearly marked, and many emergency responders did not know one building from the other. This resulted in units being assigned to one building and reporting to the other building without knowing that it was the wrong building.
- Emergency responder units that did not normally work in the lower Manhattan area were not aware of the buildings' design and construction and did not have information concerning the buildings' operating systems.
- Management of ambulance and other emergency apparatus access and exit from the site.
- Difficulties establishing a unified command system.

### ***Access and Firefighting:***

- Physiological impact on emergency responders climbing more than 10 to 12 floors during an emergency.
- Adequacy of building capacity for egress and firefighting access during full evacuation of fully occupied tall buildings. Access to high-rise buildings by emergency responders is hindered by counterflow, egress capacity, and lack of available elevators.
- Distance (i.e., remoteness) between stairwells where standpipes are located, redundant standpipe and water supply systems.
- Time factors associated with: structural fire resistance vs. firefighting/rescue operations

### ***Emergency Communications:***

- Lack of rigorous pre-emergency inspection and testing of radio communications systems within high-rise buildings to identify performance gaps and inadequacies.

- Performance requirements for emergency communication systems in buildings.
  - Design, testing, certification standards
  - Maintenance and inspection requirements
- Lack of communications network architecture (interoperability) and operational protocols for intra- and inter-agency communication at all levels of organizational hierarchy. This includes:
  - Scalability in terms of the number of emergency responders using the system and providing radio coverage in large buildings with challenging radio frequency propagation environments
  - Interoperability with existing legacy emergency communication systems
  - Localization techniques to identify emergency responders within indoor building environments
  - Conventional two-way systems versus wireless network systems

**Command and Control:** On September 11, 2001, command and control was seriously affected by the lack of effective communications. In addition, the system used for maintaining records of unit assignments at each command post was not capable of managing the numbers of units and personnel being assigned to operate at the WTC. The following are key issues related to Command and Control:

- Availability of detailed procedures and methods for gathering, processing, and delivering situational information (including voice, video, and data integration) to all emergency responders, including 9-1-1 operators, wardens, incident commander, etc.
- Availability of effective codes and protocols for establishment and uninterrupted operation of the incident command and control system, and for preservation and dissemination of information managed by command posts.
  - Command posts established within the collapse zone of buildings that received serious impact damage and contained large multi-floor fires
  - Establishing the command post prior to the request and dispatch of units in excess of the initial alarm assignments (the ability to keep track of personnel before they are sent in.)
  - Effects of self-dispatch and freelancing of emergency responders and ambulances, especially teams lacking protective clothing and medical equipment
  - Robustness of assignment and tracking (accountability) system for large-scale emergencies
- Communication of the overall command strategy to all responders relative to conducting only rescue and evacuation operations below the fire floors.

- Secure location of state and local Emergency Operation Centers.
- Rapid adoption and execution of a unified emergency response mission by all emergency responder ranks
- The dispatch of large numbers of personnel and apparatus and the ability of management to maintain accountability in a timely manner. Additionally, the ability of the incident site to effectively accommodate large numbers of personnel and apparatus.

### **E.3 REFERENCES**

Giuliani, Rudolph, W. with Kurson, Ken, *Leadership*, First Edition, Hyperion, Talk Miramax Books, New York, 2002.